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(54) **Name of the Invention** Manufacturing Method for Substrate for Optical Recording Medium

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Details of the Invention

1. Name of the Invention

Manufacturing Method for Substrate for Optical Recording Medium

2. Scope of Patent Claims

(1) What is claimed is a manufacturing method for producing optical data recording media substrate boards comprising a photosetting resin that is dripped onto both the surface of a substrate plate and on a stamper mold, which has a convexoconcave pattern; the stamper mold and resin substrate plate are superimposed in such a manner that the droplets come into contact with the same; pressure is applied to the points of contact and the droplets spread out over the surfaces; after being glued together, pressure is increased; and then ultraviolet light is made to shine on the photosetting resin causing it to harden.

(2) This is a manufacturing method for optical data recording media substrate boards as in claim 1 in which a transparent plate is exposed to an increase in pressure via a light transmission plate.

3. Detailed Explanation of the Invention

Field of the Invention

This invention is a manufacturing method for making substrate plates used as optical recording media for optical recording and reproduction of data.

Prior Art

Currently, there are a variety of cards such as credit cards, bankcards, clinic cards, etc. that contain embedded recording materials. These are primarily magnetic materials. The strong point of magnetic materials is that it is easy to write and read data. The disadvantages include the problem that the contents of the data can be easily changed, and high precision records are not possible. In order to solve these problems, there have been numerous reports that have dealt with this issue, and light cards are among the most important suggestions for optical data recording media.

Optical cards can be an important type of optical data-recording media. Generally, a laser light is used, which volatizes parts of the data recording carrier. The data is recorded and reproduced by making changes that cause differences in the reflection rate or there is a change in form that causes optical changes in the reflection rate or transparency rate. In this case, when the data is written it is not necessary to have a development process. It is possible to have what is called a DRAW (direct read after write) media recording layer. It is possible to write additional data, as high precision data is possible.

The recording media can be metallic materials or [illegible] pigments. From the standpoint of ease of handling, low cost, etc. it is the [illegible] pigments that are generally used.

Figure 2a shows a schematic cross section diagram of an existing photo card media. In this figure, 1 is a transparent resin substrate plate; 2 is an optical recording layer; 3 is an adhesive layer; 4 is a protective plate; and 5 is a track groove. According to Figure 2, data recording and reproduction is performed by optically writing and reading in transparent substrate plate 1 and track groves 5. Tracking can occur using the phasic difference of the laser light and the [illegible] convexoconcave pattern of tracking groove 5.

In this method, the convexoconcave track grooves guide the recording and reproduction of the data, and the [illegible] precision of laser beam tracking increases. High-speed access is possible when using a method employing a substrate with grooves. Also, it is possible to have a substrate plate in which the surface has been preformatted with tracking groove [illegible], tracking groove addresses, start bits, stop bits, clock signal, error correction signals, etc.

Several current methods are known for transcribing the track grooves or preformatting from the stamper mold to the substrate plate. One method is the heat transcription method and employs a thermoplastic resin. The grooves are formed by exposing the resin to a temperature exceeding the melting point and then pressing, etc. Another method involves dripping a photosetting resin onto a substrate plate. Then the stamper mold is contacted. The side with the substrate plate is exposed to ultraviolet light energy. This is the aforementioned photosetting resin and hardening method (hereafter, referred to as the 2P process).

Of these methods, the method for heat etching of the stamper mold has certain defects. The equipment is expensive, the process is time consuming, and reproduction is not good.

Compared to this, the equipment cost for the 2P process is inexpensive, it can be done in little time, and reproduction is superior. From these points it is the most appropriate method for forming substrate plates with track groves or preformatting.

Problem that the Invention Solves

However, the 2P process has problems as described below.

(1) It doesn't matter whether the resin is dripped onto the stamper mold or the transparent resin substrate plate. It is easy for bubbles to be formed in the hardened resin. These bubbles cause defects in the track grooves and preformatting layer, and this is a cause for gaps in the track guides.

(2) The thickness of the resin substrate plate is controlled. For example, if the thickness is less than the normal 2 mm, during the hardening of the photosetting resin, the substrate plate can become warped.

(3) The photosetting resin layer with the track groves and preformatting may not be of uniform thickness.

It is the purpose of this invention to solve the aforementioned problems of the 2 P process so that it can be used to form track grooves and preformatting in the manufacture of the aforementioned optical data recording media substrates. The bubbles that were present during the process of forming the track grooves and preformatting disappear. Also, there is no warping during the formation of the track grooves. Moreover, the layer that was formed with the track grooves and preformatting is uniform in thickness.

Procedure for Solving the Problem

The special characteristics of this invention of a manufacturing method for optical data recording media substrate disks is that a photosetting resin is dripped onto both the convexoconcave pattern on the surface of the stamper mold and on the surface of the resin substrate plate. The stamper and the resin substrate plate are superimposed so that the drips come in contact with both in the same way. When the pressurized drips cover the surfaces completely, the surfaces are glued together. While in the pressurized state the photosetting resin is hardened with ultraviolet light.

Following are details of this invention based on the figures.

Figure 1, (a) through (c) summarizes an embodiment of this invention of the manufacturing method for an optical recording media substrate plate. In these drawings 1 is a transparent resin substrate plate, 8 is a photosetting resin, 7 is a stamper mold, 9 is UV light, 6 is a light transmission plate, and 10 is an optical card substrate with track grooves.

The object of this invention is a manufacturing method for optical data recording substrate plates by creating a pattern (such as track groves or preformatting) on a transparent resin substrate plate 1. First, Figure 1 (a) shows a droplet of photosetting resin 8 on the surface of the transparent resin substrate plate 1 and on the convexoconcave surface pattern of stamper mold 7. Then, both of photosetting resin 8 droplets are evenly joined together by overlapping stamper mold 7 and transparent resin substrate plate 1. While under high pressure, transparent resin substrate plate 1 and stamper mold 7 are

slowly joined so that as they are glued together, the point of contact of the droplets spreads across the surface.

Then, Figure 1 (b) shows the light transmission plate being used to apply high pressure to the transparent resin substrate1. Then, while the pressure is still being applied, ultraviolet light 9 shines through transparent substrate plate 1 and hardens aforementioned photosetting resin 8. In the case when stamper mold 7 is not transparent, the ultraviolet light shines through the side with transparent resin substrate plate 1. Also, if the stamper mold is transparent, the light can shine through the side of stamper mold 7.

Next, Figure 1 (c) shows that after photosetting resin 8 has hardened, stamper mold 7 is removed. Then it is possible to obtain an optical card substrate plate 10 with tracking grove photo guides that has been transcribed from the convexoconcave pattern of stamper mold 7. The depth, width, precision, pitch interval, etc. of the track grooves on said optical card substrate plate 10 are dependent on the transcription conditions of stamper mold 7. Depending on the precision and care of the groves on the stamper mold 7, the proceeding is a reliable method for manufacturing optical card substrate plates 10 with track grooves.

For this invention, it is best if there is more than one droplet of the photosetting resin dropped on the surface of the transparent resin substrate plate and on the surface of the stamper mold. Also, there must be an adequate total volume of resin of the droplets so that the resin can fill up the tracking grooves, preformatting or other pattern. The amount will differ depending on the size of the substrate plate, but as an example 0.01 to 1.0 milliliter is desirable.

For transparent resin substrate plate 1 that is used in this invention, it is desirable to use a material that can be optically recorded and reproduced with few [illegible irregularities?], that has a high degree of smoothness, high transparency to the laser light that is used for recording and reproduction, and has low birefringence. Normal resins are used such as those used in plastic substrate plates and film. For example, acrylic resin, polyester type resins, polycarbonate type resins, vinyl type resins, polystyrene type resins, polyimide type resins, and polyacetal type resins, etc. These have a good transparency rate for laser light. . Moreover, the acrylic type resins and the polycarbonate type resins have low birefringence. Moreover, it is desirable that transparent resin substrate plates be very smooth and have a thickness in the range of about 0.3 to 0.5 mm.

Light transmission plate 6 is used to protect the transparent resin substrate plate from waving and warping. It is desirable for the material to be smooth and transparent to ultraviolet light. Examples are BK7, quartz glass, etc.

Good materials to use for the photosetting resin utilized in this invention are the materials that are publicly known as suitable for the 2P process and that are sold commercially. It is desirable if transparency is not lost during molding and that the difference in the refractive index is within 0.05. It is also desirable that the said transparent resin substrate plate can be easily glued, and that the stamper mold can be easily detached. Good examples are epoxy acrylate type resins, urethane acrylate type resins, etc.

Also, it is desirable if stamper mold 7 of this invention has a convexoconcave pattern on the stamping surface. For example, a pattern of groves, preformatting, or other pattern is etched or otherwise put onto a glass plate, quartz plate, or other type of transparent

plate. It is also possible to use, extra hard and [illegible] etc. metal that has been etched with a pattern of tracking grooves, preformatting, etc.

Operation

In the existing 2P process, the photosetting resin is dripped onto only either the substrate plate or the stamper mold. However, it is easy for bubbles to remain when the substrate plate and the stamper mold become glued together. In the manufacturing process for making optical data recording substrate media plates of this invention, photosetting resin is dripped onto the convexoconcave pattern on the surface of the stamper mold and onto the surface of the substrate plate. The stamper mold and the substrate are superimposed so that the drops of resin come into contact with the same. Pressure is applied so that the contact points of the resin spreads out and the bubbles that were included disappear.

Also, in this invention a light transmission plate is used to apply pressure to the substrate. It is used when the photosetting resin is being hardened can keep the substrate from warping.

Embodiments

Following are concrete descriptions of embodiments of the invention.

Embodiment 1.

The substrate plate is made of polycarbonate and measures 150 mm in length, 150 mm in width and is 0.4 mm in thickness ("banraito" 2H manufactured by Teijin Chemicals, Ltd.). The photosetting resin (0.3 ml), epoxy acrylate (30 x [illegible 0B2 or 082], manufactured by Three Bands Company) is dripped onto the upper surface in the center.

Also, the stamper mold is a strong plate measuring 150 mm in length, 150 mm in width and is 3 mm thick. The stamper mold has been etched with a convexoconcave pattern. To the center of the stamper mold is dripped 0.3 ml of photosetting resin epoxy acrylate (30 x [illegible 0B2 or 082] manufactured by Three Bands Company).

Next, the polycarbonate plate is superimposed over the stamper []. The two are gradually made to touch and be laminated. Also, above the polycarbonate substrate plate is placed a quartz glass plate that measures 150 mm in length, 150 mm in width and is 20 mm thick. A pressure device gradually increases the pressure on the resin plate until it reaches 200 kg/cm^2. Then, the polycarbonate substrate plate is exposed through the quartz plate to ultraviolet light from a high-pressure mercury lamp (intensity of illumination 160 W/cm, distance 10 cm, time period 30 seconds). Next, the quartz glass plate is removed from the polycarbonate substrate plate, and the substrate plate is peeled off of the stamper mold producing a transparent resin substrate plate with tracking grooves.

As the bubbles that were in the transparent resin substrate plate have disappeared, the layer with the tracking grooves or preformating does not have defects and there is no warping. Also, the photosetting resin layer in which the tracking grooves have formed has a uniform thickness of about 10 μm.

Embodiment 2

The polycarbonate substrate plate is 150 mm long, 150 mm wide and 0.4 mm thick ("Pantoraito" 251, manufactured by Teijin Chemicals, Ltd.). In the center, on the top is dropped 0.3 ml of photosetting resin, epoxy acrylate (MRA201, manufactured by Three [illegible] Rayon).

... Also, the stamper mold is a quartz glass plate measuring 150 mm in length, 150 mm in width and is 3 mm thick. The stamper mold has been etched with a convexoconcave pattern. To the center of the stamper mold is dripped 0.3 ml of photosetting resin epoxy acrylate (MBA [illegible, could be MRA or MHA] 201 manufactured by Three [illegible] Company).

Next, the polycarbonate substrate plate is superimposed on the aforementioned subantaa mold. The two are gradually made to touch and be laminated. Also, above the polycarbonate substrate plate is placed a quartz glass plate that measures 150 mm in length, 150 mm in width and is 20 mm thick. A pressure device gradually increases the pressure on the resin plate until it reaches 200 kg/cm^2. Then, the polycarbonate substrate plate is exposed through the quartz plate to ultraviolet light from a high-pressure mercury lamp (intensity of illumination 160 W/cm, distance 10 cm, time period 30 seconds). Next, the quartz glass plate is removed from the polycarbonate substrate plate, and the substrate plate is peeled off of the stamper mold producing a transparent resin substrate plate with tracking grooves.

As the bubbles that were in the transparent resin substrate plate have disappeared, the layer with the tracking grooves or preformatting does not have defects and there is no warping. Also, the photosetting resin layer in which the tracking grooves have formed has a uniform thickness of about 10 μm.

Effect of the Invention

In the description above, in this invention the photosetting resin is dripped onto the surface of both the stamper mold and the substrate plate. At the points of contact the pressure is increased while the photosetting resin is hardened, which makes the bubbles that are included disappear. The pattern of tracking groves or preformatting, etc. form without defect. AT does not have gaps, etc. and it is possible to use this manufacturing method to make the tracking grooves in optical data recording substrate plates.

Also, the substrate plates are smooth and transparent. While the pressure is being increased the photosetting resin is hardened so that the undulations and warping does not occur. The photosetting resin thickness is uniform.

4. Brief Explanation of the Figures

Figure 1 (a) through (c) shows simplified process drawings of an example of an embodiment of this invention for a manufacturing method for making optical data recording substrate plates. Figure 2 shows schematic cross sections of an existing optical card.

1-Transparent resin substrate plate
2-Optical recording layer
3-Adhesive layer
4-Protective plate

5-Track groove
6-Light transmission plate
7-Stamper mold
8-Photosetting resin
9-UV light rays
10-Optical card substrate

Figure 1.

(a)

6 Light transmission plate
1 Transparent resin substrate plate
8 Photosetting resin
7 Stamper mold

(b)

9 Ultraviolet light rays
6 Light transmission plate
1 Transparent resin substrate plate
8 Photosetting resin layer
7 Stamper mold

(c)

10 Optical card substrate plate
8 Photosetting resin layer
1 Transparent resin substrate plate

Figure 2.

4 Protective plate
3 Adhesive layer
2 Optical recording layer
1 Transparent resin substrate plate
5 Track groove